

Clean Economy Skills for the Future Workforce

Training Needs Analysis for the
Advanced Manufacturing Industry

A hand is shown holding a glowing globe of the Earth. The globe is illuminated from below, creating a bright orange and yellow glow. Overlaid on the globe is the text 'CO2' in large, white, sans-serif font. Below the 'CO2' text are five small, blue, downward-pointing arrows. The background is a dark blue sky with a cityscape at night, visible through a window or glass pane. A green leaf is visible on the left side of the frame.

CO₂

This report identifies the clean economy skill needs of the advanced manufacturing sector in the Geelong region.

Manufacturing is a key priority for the region to reduce emissions and align to The Victorian Government's strong action to reduce Victoria's emissions to net zero by 2045.

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The Gordon acknowledges Project Advisory Group members



**Geelong
Tech
School**

Skilling
THE BAY

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Clean Economy Skills for the Future Workforce: Training Needs Analysis for the Advanced Manufacturing Industry

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What is the Clean Economy?



Climate change mitigation and adaptation

Activities to prevent or reduce emissions, and processes to adjust to the current and future effects of climate change.

Climate mitigation

- The efforts and actions taken to reduce greenhouse gas emissions or remove them from the atmosphere
- Reduces the extent of climate change.

Climate adaptation

- Adjustments societies and ecosystems implement to cope with the impacts of climate change
- Involves proactive measures to minimise vulnerabilities and build resilience.
 - » Moving away from fossil fuel
 - » Adopting alternative fuels
 - » Designing infrastructure with climate resilience
 - » Conserving water used for manufacturing.



Renewable energy

Transition from fossil fuels to renewable energy sources, including solar, wind, tides and geothermal heat.

Renewable energy

- Biomass energy, hydro energy, solar energy, wind energy, geothermal energy and ocean energy.
 - » Biomass energy conversion technologies
 - » Geothermal heat
 - » Electricity production
 - » Wind conversion.



Circular economy

An economic system that focuses on the sustainable use of resources, including reuse, repair, remanufacture and recycling.

Circular or regenerative economy

- Economic system that is restorative and regenerative by design
- The goal is to design products, components and materials to regenerate to their highest utility and value, and this is done through consciously designing resource pathways in advance
- Product design for durability and reusability:
 - » initiatives to reduce waste and conserve materials
 - » implementing product hiring and subscription business models.

Introduction

Transitioning to a clean economy in the advanced manufacturing industry requires a systematic approach encompassing manufacturers, consumers, regulatory bodies, education and other relevant stakeholders.

With the challenges arising from finite resources, finances and time to support this transition, it is important to understand the opportunities and challenges for increasing skills and capabilities among the current and future workforce.

The Gordon TAFE has implemented a Victorian government grant to deliver the project, "Identifying Clean Economy Training Needs of the Advanced Manufacturing Industry". In early 2023 collaboration began with The work with Geelong Manufacturing Council, the City of Greater Geelong and the Geelong Tech School.

This research report, Training Needs Analysis Summary Report, is the first of four project deliverables. The Report provides findings and recommendations following an extensive industry consultation comprising think tank workshops, semi-structured phone interviews and an online survey, collecting data from manufacturers and related industries in the Geelong region.

This Report captures the perspectives of manufacturers in the Geelong region, and the capabilities they require to transition to the clean economy.

The findings and recommendations of the Training Needs Analysis Report will support The Gordon's planning for future training needs towards a clean economy as well as support Victoria's Clean Economy Workforce Development Strategy 2023-2033.

The Report provides:

- a planning and investment framework to support the advanced manufacturing workforce development
- recommendations for training pathways to meet the industry's growing demand for skills.



Context: Victoria's Clean Economy Workforce Development Strategy 2023-2033

Targeted training and skills programs will address the increased skills demand in key sectors including manufacturing, engineering, electricity and construction.

It is expected that the strategy will help meet Victorian's clean economy targets including the 95% renewable energy by 2035.

The plan specifically focuses on enhancing the workforce's capability and capacity to effectively transition to Victoria's transition towards a clean economy.

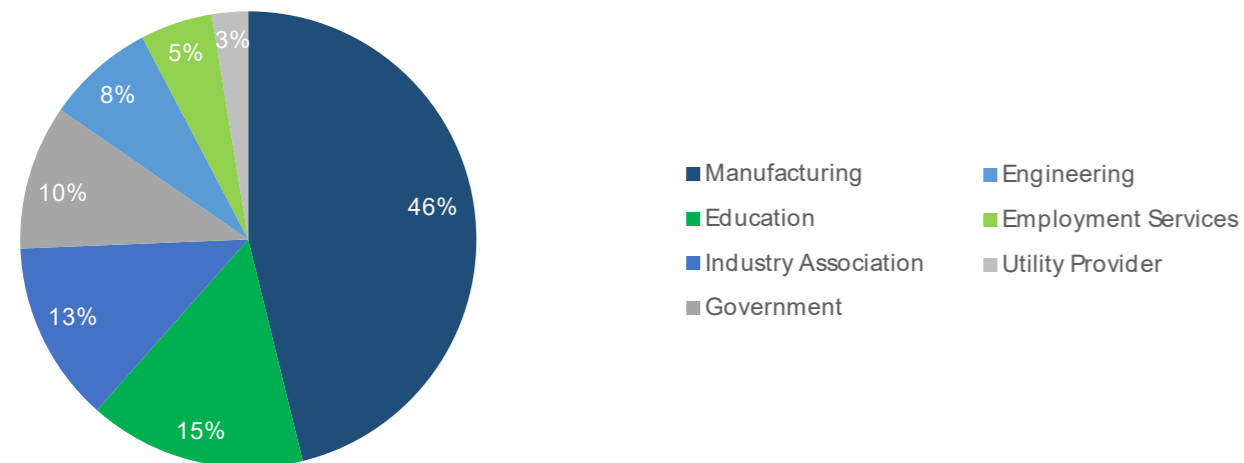
The strategy also aims to ensure that the workforce are ready to seize opportunities as part of the transformation and reform of Victoria's waste and recycling industry.



Methodology

The organisations that participated in the consultation represented different industry sectors from across the Geelong region.

They also varied in terms of organisational size and where they were positioned in their clean economy transition journey.



Key Findings and Recommendations

Future-proofing Victoria's education sector to embed and add required capability to drive manufacturing transformation towards a clean economy, comes with substantial opportunity.

Key Finding 1. Technology and Infrastructure



Challenges

Manufacturing companies require the necessary infrastructure, tools and expertise to experiment with and implement sustainable and innovative solutions.

Existing facilities are often not equipped to accommodate these changes. Retrofitting or redesigning facilities to accommodate clean technologies can be complex and costly.



Opportunities

- Physical facilities for experimentation
 - » Adopt clean economy practices and reconfigure manufacturing processes and integrate new technologies.
- Access to infrastructure and specialised tools/ equipment/machines
 - » Increase access to such tools to support the adoption of clean technologies.
 - » Train employees to operate specialised tools effectively may require additional investment.

Key Finding 2. Development of business cases for clean economy initiatives



Challenges

Development of clear business cases for adopting clean economy practices. Being able to present clear financial outcomes and highlight the competitive advantages of clean economy-related initiatives is needed.

Currently, estimating the financial benefits of clean economy practices is challenging due to initial investment costs versus long-term savings. Predicting profitability gains is uncertain, leading to decision dilemmas and hesitation in committing to change.



Opportunities

- Clarify ways to create a competitive edge to transition to the clean economy
 - » Identify competitive advantages of clean economy practices.
 - » Strategic marketing highlighting the environmental and social benefits or improved product quality could help justify the business case.
 - » Incentives to adopt clean economy changes and technologies varies across industries and markets, therefore a focused effort on each sector could showcase the advantages more effectively.

Key Finding 3. Promotion of the clean economy transition



Challenges

Shifting norms and behaviours when promoting transition to a clean economy requires a holistic approach including effective communication, skills and training, change management as well as commitment from leadership.

There are concerns about disruption, additional costs, and uncertainty about the effectiveness of new approaches.

There is a perception of clean economy practices as an added burden, a fear of the unknown, or a deviation from the norm.



Opportunities

- Provide further industry specific information for organisations about the need for and benefits of transitioning to a clean economy.
- Support the embedding of sustainability into an organisation's values, decision-making processes and day-to-day operations.
- Foster a culture of innovation, adaptability and open-mindedness.
- Support leadership commitment, consistent messaging and alignment of incentives and rewards with sustainable practices and transition opportunities.
- Communicate benefits of aligning to the clean economy through a long-term vision for the organisation to alleviate fears and uncertainties
- Highlight successful industry-specific clean economy initiatives and their positive impacts to inspire confidence in the transition and showcase the organisation's commitment to positive change.



Skill Requirements of the Advanced Manufacturing Sector to Transition to the Clean Economy

Transitioning the advanced manufacturing industry to a clean economy requires comprehensive skill sets, including both technical and transferable skills.

Among the identified skills sets, technical skills were critical, to drive innovation, optimise operations and to make strategic decisions that align with clean economy principles.

Technical skills



- General and advanced technology skills in manufacturing
- Specialised technical skills for clean technology innovations
- Clean economy integration skills
- Data driven decision making
- Cross-disciplinary knowledge of business/engineering /clean economy nexus

Transferable skills



- Innovation and change management
- Collaboration and communication
- Other transferable skills

Specific Skills for the Clean Economy Transition

Specific skills



Manufacturers agreed, as for any transition, for the advanced manufacturing sector to transition to a clean economy, transferable skills play a significant role in complementing the technical expertise of the workforce.

The successful integration of clean economy practices demand the need for professionals who can manage change, communicate effectively and engage stakeholders.

The technical and transferable skills identified in industry consultations are categorised and the identified specific skills under each category are given in this table.

Skill category	Skills	Skill category	Skills
General and advanced technology skills	<ul style="list-style-type: none"> Process engineering Product design Maintenance engineering Automation, robotics and mechatronics Computer-aided design and (CAD/CAM) manufacturing Lean manufacturing practices Additive manufacturing (3D printing) Simulations with digital twins 	Data-driven decision making	<ul style="list-style-type: none"> Data collection & analysis Data visualisation & interpretation Database management and data ethics Predictive analytics Statistical analysis & strategic planning Decision optimisation Problem-solving & critical thinking Scenario modelling & simulating digital twins Multi-criteria decision analysis
Specialised technical skills for clean technology innovation	<ul style="list-style-type: none"> Renewable energy/integrating renewable energy systems into production facilities Energy storage and distribution systems Energy-efficient technologies and innovations skills Hydrogen energy as a renewable energy source 	Innovative and change management	<ul style="list-style-type: none"> Customer-centricity in innovations Change management Adaptability Risk identification & management Troubleshooting Curious mind-set Passion for learning Intrapreneurship
Clean economy integration skills	<ul style="list-style-type: none"> Energy audit/assessment Clean energy financing Environmental impact assessment Environmental policy advocacy Carbon mitigation technologies LCA (Life Cycle Assessment) & environmental footprint analysis Supply chain mapping & management Material science of alternative materials Sustainable materials sourcing Incorporating circular economy principles in design Circular procurement Environmental compliance Sustainability reporting and governance Systems thinking 	Collaboration and communication	<ul style="list-style-type: none"> Collaboration with stakeholders Communication Negotiation Teamwork Influence and persuasion
		Other transferable skills	<ul style="list-style-type: none"> Ethical awareness Emotional intelligence
		Identified Skills	<ul style="list-style-type: none"> Leadership Cultural sensitivity Self-awareness Self-management
Cross-disciplinary integration skills	<ul style="list-style-type: none"> Business case for technical innovation in the clean economy Economic models to enable a circular economy Interdisciplinary communication Project management across disciplines Policy and technical integration across disciplines Preparation of a roadmap to introduce a new green product/ business line 		

Clean Economy Transition Skills

Supporting Clean Economy Skills and Training

Transitioning the advanced manufacturing industry to a clean economy demands a skilled and adaptable workforce equipped with the knowledge and expertise to identify and implement changes to current practices. This requires continual adaptation skills and change management.



Micro credentials and short courses:

These focused, specialised programs offer the flexible approach required to learning and enable individuals to upskill or reskill in specific skills relevant to the clean economy without committing to lengthy academic programs.



Industry-relevant specialised courses:

Incorporate specialised training programs that address skills specifically required by the industry not currently covered in traditional university or TAFE programs, focusing on clean economy principles.



Best practice case studies from the industry:

Provide students with access to best practice industry case studies to enhance understanding of real-world applications of clean economy principles, gain insights into successful strategies and problem-solving strategies, and hone critical thinking and decision-making skills.



Common clean economy literacy and communication:

Establishing awareness and basic education initiatives, such as workshops and webinars, can ensure both technical and non-technical staff possess a shared vocabulary and grasp of clean economy concepts.



Pooled graduate programs:

Collaborative pooled graduate programs involving multiple industries can offer a cross-disciplinary learning experience where graduates gain varied exposure across different sectors, broadening their understanding of clean economy opportunities.



Career selection support for graduates:

Sourcing and promoting mentorship programs, career counselling and internships within clean economy industries can guide graduates toward fields where workforce will be required

Key Recommendations

Small-sized organisations, especially those scaling up, and they find it challenging to drive clean economy initiatives with dedicated resources, unless there was inherent integration of clean economy practices into business models.

For small and medium sized companies, the values and aspirations of executive teams to transition to a clean economy play an inherent role in driving innovation.

Group	Skill	Example	How?
Vocational and tertiary students	General and advanced technology skills	General manufacturing-oriented, design and engineering skills	Covered with current study programs/extend study programs
	Specialised technical skills towards clean economy innovations	Hydrogen, material science etc., renewable energy, energy storage	Introduce new study modules
	Clean economy integration skills	Carbon accounting	Introduce new study modules
	Cross-disciplinary knowledge of business/engineering/clean economy nexus	Business case for a technical innovation in the clean economy	Introduce new study modules/ overlay current modules and assess Industry collaborated; instructor/industry-supervised projects offered for current students/ graduates as modules
	Data-driven decision making	Big data analysis, statistical analysis and decision making	Introduce new study modules/ overlay current modules and assess
	Innovation and change management	Customer-centricity in innovations, adaptability Risk identification & management, troubleshooting, curious mind-set, intrapreneurship	Introduce new study modules/ overlay current modules and assess Industry collaborated; instructor/industry-supervised projects offered for current students/ graduates as modules Work integrated learning programs offered as internships
	Collaboration and communication	Collaboration with stakeholders, communication & teamwork	Work integrated learning programs offered as internships Graduate pooling programs to cross-training graduates with multiple businesses through an inter-industry collaborative partnership program
Early and mid-career professionals	Other transferable skills	Ethical awareness & leadership	Work integrated learning programs offered as internships Work-readiness programs Overlaying current modules and assess
	Clean economy	Carbon accounting	Short courses for continuous professional development offered as micro-credentials
	Advancement of current professional practice knowledge	Sustainable sourcing/ procurement, sustainable material choices	Short courses for continuous professional development offered as micro-credentials Peer-learning through communities of practice Sharing of case studies and best practices
Top and executive level professionals	Cross-disciplinary integration skills	Clean economy/business/systems thinking	Exposure to cross-disciplinary projects Professional coaching/mentoring Peer-learning through communities of practice Sharing of case studies and best practices
	Clean economy	Carbon accounting	Short courses for continuous professional development offered as micro-credentials
	Innovation leadership skills	Engineering entrepreneurship	Professional coaching/mentoring
	Advancement of current professional practice knowledge	Preparation of a roadmap to introduce a new green product/ business line	Short courses for continuous professional development offered as micro-credentials

The key factors driving transition to a clean economy for most organisations.

Beyond Upskilling Graduates

While upskilling is essential to create awareness and knowledge on clean economy-related areas, it is equally important to upskill the workforce for applying and integrating these skills into practice. Therefore, strategies for re-skilling and cross-skilling are recommended as much as upskilling.

- Organisations stated that upskilling for the clean economy transition is specifically required for middle-level managers and executives.
- Relevant programs are suggested for career entrants to industries and mid and senior managers and executives.
- With the need to upskill, cross-skill and re-skill the existing employee base, it is recommended that the following programs are designed and made available to the industry to support:
 - » Programs that support professionals with prior experience in relevant or non-relevant professional experience to complete – such as online, micro-credentials and Community of Practices.
 - » Support for career changes, supporting professionals from different disciplines to navigate and transition to areas specialising in clean economy.
 - » Enable scaffolded learning, supporting professionals to take a step-by-step approach and continuous professional development programs which are offered as short courses.

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